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OBSERVATIONS ON THE BUMBLE-BEES IN LUBLIN

(Ekol. Pol. 19: 401–417). Studies were made in 1964 and 1966 on the quantitative occurrence of bumble-bees in Lublin, the species composition of these insects and of the plants they visit. Observations were made by catching bumble-bees visiting flowering plants in parks, squares, lawns, waste-land etc. 15 species of bumble-bees were found to visit 64 species of plants.

The species composition of bumble-bees in Poland is relatively well-known owing to the studies made by Alfken (1909, 1912a, 1912b), Blüthgen (1919, 1942), Drogoszewski (1932), Dylewska (1957, 1958, 1962, 1966), Honczarenko (1965), Ruszkowski (1968a, 1968b, 1969a), Śnieżek (1910), Szulczewski (1948) and Wierzejski (1868, 1874). Ruszkowski in addition investigated the food relations of different species of bumble-bees (1969b, 1969c, 1969d, 1969e). Comparatively little is known, however, about the occurrence of these beneficial insects and their host plants in urban habitats. The present study is an attempt at explaining this problem, using Lublin as an example.

Observations of the occurrence of bumble-bees in Lublin were made in 1964 and 1966. Numerous visits were made to different parts of the town, during which collections were made of bumble-bees visiting flowering plants in parks,

cemeteriès, squares, lawns and also in allotments and private gardens, and in fields and on wasteland on the outskirts of the town. Observations started in early spring, when willows (*Salix caprea* L.) were in flower. On account of the way in which the bumble-bees reproduce, however, the majority of the collections were made in the second half of summer and in the autumn, by which time the bumble-bee families were well developed and a large number of males had appeared.

DESCRIPTION OF PLACES AND AREAS FROM WHICH BUMBLE-BEES WERE COLLECTED

Lublin is an extensive town and its different districts are characterized by different density of buildings and management of free space. It has a relatively small amount of large green areas, and there are few squares and flower

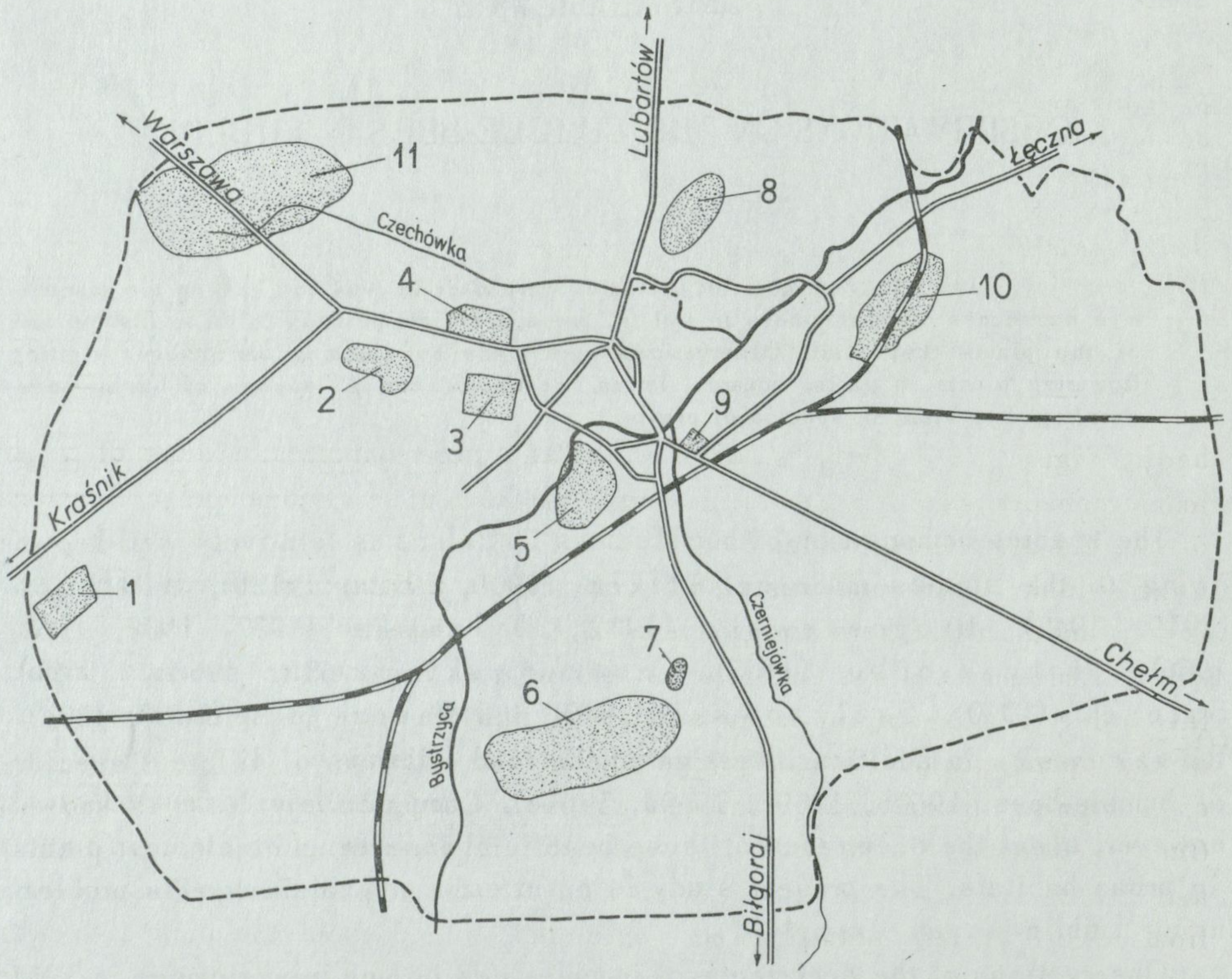

Fig. 1. Plan of Lublin showing location of more important green areas in which the studies were made

1 – Węglin-quarter, *2* – University Campus, *3* – Lipowa street cementery, *4* – Saxon Garden, *5* – People's Park, *6* – Wrotków-quarter, *7* – Dziesiątka quarter, *8* – Unicka street cemetery, *9* – Town park at Bronowice, *10* – Tatary quarter, *11* – Sławinek quarter

Bumble-bees occuring in Lublin Tab. I

Species of bumble-bees \ Town quarter	Slawinek quarter	Saxon garden	People's Park (Park Ludowy)	Lipowa Street cementery	Unicka Street cementery	University Campus	Tatary quarter	Dziesiata quarter	Wrotkow quarter	Other quarters jointly	Total
B. lapidarius (L.)	84	10	100	1	12	173	243	17	74	5	719
B. terrestris (L.)	21	2	20	9	9	182	135	30	57		465
B. hypnorum (L.)	2		19	8		28	12	47	12		128
B. ruderarius (Müll.)	1		2	9	18	6	25	7	21		89
B. agrorum (F.)	1		3	11	11	10	14	25	6		81
B. hortorum (L.)	4		2	3	18	4	5	8	15		59
B. lucorum (L.)	2		4			3	4	2	4		19
B. muscorum (F.)			1			1	5		4		11
B. silvarum (L.)					1	1	6				8
B. subterraneus (L.)							1		7		8
B. confusus Schenc.	1					3					4
B. pomorum Pz.							2				2
B. pratorum (l.)						2					2
B. equestris (F.)									1		1
B. humilis Ill.									1		1
Total	116	12	151	41	69	413	452	136	202	17	1597

beds. Figure 1 gives the distribution of the more important groups of trees and green areas within the town area, on which observations and collections of bumble-bees were made.

Sławinek – park and wasteland. The park is a botanical garden. The area is very undulating. There are groups of old trees and shrubs which have become wild. Numerous valleys and slopes, often well exposed to sunlight, create favourable conditions for many species of bumble-bees to settle there. Part of the open space without trees or shrubs has been used for the cultivation of perennial and annual plants of the following families: *Campanulaceae*, *Caryophyllaceae*, *Compositae*, *Crassulaceae*, *Cruciferae*, *Labiatae*, *Liliaceae* and others. In this part of the area many of the plants flowered abundantly from spring to late autumn. The wasteland lying outside the park area was similar in character to a neglected meadow. Thistles and weeds of the *Labiatae* and *Ranunculaceae* families grew abundantly there. 116 (7.3%) of all the bumble-bees were caught at Sławinek. *Bombus lapidarius*[1] (84 individuals)

[1] Full names of species of bumble-bees (species names and authors' names) are listed in Tab. I.

clearly dominated among them, *B. terrestris* (21 individuals) occurred less numerously. The species *B. hortorum*, *B. hypnorum*, *B. lucorum*, *B. ruderarius*, *B. agrorum* and *B. confusus* were only sporadically encountered (Tab. I). Bumble-bees most often visited flower plants of the *Compositae* family, and decidedly preferred *Carduus acanthoides*[2]. The following plants were visited by single individuals: *Ballota nigra*, *Salvia officinalis*, *Campanula* sp. and others.

Ogród Saski (Saxon Garden), town park. The area on which the park is situated is undulating, but less varied than the park at Sławinek. The old tree stand is supplemented by younger planted trees. Numerous shrubs grow there (*Symphoricarpos albus*, *Spirea* sp., *Rosa* sp., *Forsythia suspensa*). There are very few perennial and annual ornamental plants (*Salvia splendens*, *S. officinalis*, *Viola tricolor maxima hort.*, *Tagetes erectus*). Small numbers of bumble-bees belonging to the species *B. lapidarius* and *B. terrestris*, mainly visiting *Symphoricarpos albus*, *Rosa canina* and *Tagetes erectus*, were observed in the Saxon Garden. 12 individuals were caught. Park Ludowy (People's Park). The newest park in Lublin, which was laid out in the drained marsh area in the valley of the river Bystrzyca. The tree stand here is completely young (first trees planted in 1953). There are a few older trees along the northern fringe only. There is a considerable amount of open well insolated space in this park. There are also many flower beds in which *Tagetes erectus*, *Zinnia elegans*, *Dahlia variabilis*, *Salvia officinalis*, *S. splendens*, *Antirrhinum maius*, *Viola tricolor maxima hort.*, *Begonia* sp., *Sedum* spp. and others have been planted. The main flowering shrubs are *Symphoricarpos albus*. On the eastern side near the River Bystrzyca the park is badly infested by *Carduus acanthoides* and to a slightly lesser degree by *Malva silvestris*. There are a large number of suitable places in this park for the bees to make their nests. A great many bumble-bees occurred in this park (151 individuals, 9.4%), *B. lapidarius* decidedly dominating (100 individuals). This bee visited mainly *Carduus acanthoides* and *Symphoricarpos albus*. The species *B. terrestris* was encountered fairly frequently but in smaller numbers (20 individuals) and also *B. hypnorum* (19 individuals); they visited the flowers of *Dahlia variabilis*, *Zinnia elegans*, *Carduus acenthoides*, *Malva silvestris* and *Symphoricarpos albus*. Only single individuals belonging to the species *B. lucorum*, *B. agrorum*, *B. hortorum*, *B. ruderarius* and *B. muscorum* were observed.

Lipowa Street Cemetery. There are many old trees giving a considerable amount of shade in the oldest part of the cemetery. In the more recent part there are few trees, but many shrubs (*Rosa* sp., *Spirea* sp., *Symphoricarpos albus*). There is a great variety of abundantly flowering perennial and annual plants in flowerbeds. Plants are either planted out in the soil or in vases,

[2] Full names of plants (species names and authors' names) are listed in Tab. II.

and there are a great many cut flowers present (*Dahlia variabilis*, *Begonia* sp., *Salvia officinalis*, *S. splendens*, *Callistephus chinensis*, *Tagetes erectus*, *Zinnia elegans*, *Solidago* sp. and others). The following plants grow in the neglected parts of the cemetery: *Impatiens glanduligera*, *I. parviflora*, *Tanacetum vulgare*, *Solidago* sp. A total of 41 bees were caught (2.3%), among which the most numerous species proved to be *B. agrorum* (11 individuals), *B. terrestris* (9 individuals), *B. ruderarius* (9 individuals) and *B. hypnorum* (8 individuals). A nest of this last species was found in the window of the cemetery keeper's house in which the missing panes had been replaced by plywood. *B. lapidarius* and *B. hortorum* on the other hand occurred singly (1 and 3 individuals). Bumble-bees most readily visited the flowers of *Dahlia variabilis*, *Tagetes erectus*, *Salvia officinalis*, *Impatiens glanduligera* and *Zinnia elegans*.

Unicka Street Cemetery and neighbouring wasteland. The cemetery is situated on a gentle slope with southern exposure. In the northern part, which is the highest, there are a few old trees, and the lower part, almost treeless, has many shrubs (chiefly *Rosa* sp. and *Spirea* sp.). There are numerous flower beds containing perennial and annual plants (*Solidago* sp., *Salvia officinalis*, *S. splendens*, *Callistephus chinensis*, *Aster* sp., *Sedum* spp., *Dahlia variabilis*, *Tagetes erectus*, *Antirrhinum maius*, *Zinnia elegans*, *Viola tricolor maxima hort.*, *Begonia* spp. and others).

The wasteland adjoins the cemetery on the east side. Roughly in the middle there is a depression of both natural and artificial origin, the latter the result of digging clay for brickmaking. The northern bank is higher, and at the top covered by grass which periodically dries up. At the foot of this bank wasteland has formed, changing gradually into neglected meadow rising gently from the south side. *Knautia arvensis* flowered on the bank and *Prunella vulgaris*, *Trifolium pratense*, *T. repens*, and *Geum* sp. in the meadow.

A total number of 69 bumble-bees (4.3%) were caught in the cemetery and the nearby wasteland. Among these *B. lapidarius* occurred most frequently (12 individuals), *B. hortorum* (18 individuals) and *B. ruderarius* (18 individuals), a nest of this latter species being found in the neglected meadow hidden in a tuft of grass. *B. agrorum* (11 individuals) and *B. terrestris* (9 individuals) also occurred there. The bumble-bees were most often caught on the flowers of *Salvia officinalis* and *Trifolium pratense*.

Miasteczko Uniwersyteckie (University Campus). The folded area of the Campus can be divided into two main parts. The grassy part – with numerous flowerbeds containing large numbers of plants flowering throughout almost the whole of the growing season (*Veronica sp.*, *Tagetes erectus*, *Dahlia variabilis*, *Antirrhinum maius*, *Zinnia elegans*, *Begonia* spp., *Salvia splendens*, *A. officinalis*, *Rudbeckia laciniata*, *Sedum* spp., *Rosa* spp. and others). The second part, called the Town Botanical Garden, is planted with many species

of trees and shrubs and abundantly flowering herbaceous plants belonging to the following families: *Campanulaceae*, *Caryophyllaceae*, *Compositae*, *Crassulaceae*, *Cruciferae*, *Labiatae*, *Liliaceae*, *Papilionaceae* and others. There are several well insolated sites in this area covered by unmown grass. There are also a large number of rodents' corridors, which provide favourable conditions for the settlement of some species of bumble-bees. Nests of *B. lapidarius* and *B. terrestris* situated close to each other (about 15 m apart) were found in this part. The grass part, frequently mown, almost completely without trees and shrubs, does not favour the nesting of bumble-bees.

Bumble-bees visited flowering plants in the botanical garden, but there were far more of these insects in the dense flower beds in the lawn area, where they appeared most numerously on the flowers of *Dahlia variabilis* and *Tagetes erectus*. A total of 413 individuals (25,9%) were caught in the University Campus *B. terrestris* (182 individuals) and *B. lapidarius* (173 individuals) occurred in the greatest numbers. The species *B. hypnorum*, *B. agrorum*, *B. ruderarius*, *B. hortorum*, *B. lucorum*, *B. confusus*, *B. pratorum*, *B. muscorum* and *B. silvestris* appeared sporadically only.

Tatary quarter wasteland adjoining the new housing settlement situated on the outskirts of the town extends along the railway track and is bordered by a cultivated field. This is a flat area on a limestone substratum, with characteristic vegetation. In spring *Tussilago farfara* L. flowers there abundantly, and in summer and autumn, different species of *Centaurea*, *Anchusa officinalis*, *Echium vulgare*, *Ononis spicata* and *Ballota nigra*, *Phacelia tanacetifolia* and *Carduus* spp. occur in patches. The wasteland occupies an open area, almost completely devoid of shrubs, and is covered by rough turf, dry and well insolated. Conditions for the settlement of some species of bumble-bees are fairly good there.

Bumble-bees, of which 452 individuals were caught (28.3%), occur numerously in this area. *B. lapidarius* dominated (243 individuals). The subdominant was *B. terrestris* (135 individuals). Other species of bumble-bees: *B. ruderarius*, *B. agrorum*, *B. hypnorum*, *B. silvarum*, *B. hortorum*, *B. muscorum*, *B. lucorum*, *B. pomorum* and *B. subterraneus* appeared in small numbers or even sporadically. *B. lapidarius* chiefly visited the flowers of different species of *Centaurea*, and also frequently appeared on the flowers of *Carduus* spp., *Anchusa officinalis* and *Echium vulgare*. *B. terrestris*, on the other hand, rarely visited the flowers of *Centaurea*, but decidedly preferred *Anchusa officinalis*, *Echium vulgare* and *Carduus acanthoides*.

Dziesiąta quarter. Private gardens. These gardens are bordered by an open cultivated field. They contain fruit and ornamental trees and bushes, and plants cultivated as vegetables or for their flowers. 136 bumble-bees (8.5%) were caught in these gardens. *B. hypnorum* came first in order of numbers

(47 individuals), and visited chiefly the flowers of *Ballota nigra*, *Helianthus annuus* and *Rubus idaeus*, then *B. terrestris* (30 individuals) and *B. agrorum* (25 individuals) visiting the flowers of *Tagetes erectus*, *Helianthus annuus*, *Ballota nigra* and others. *B. lapidarius*, numerous in other districts, was represented by 15 individuals in the private gardens of Dziesiąta. Bumble-bees belonging to the species *B. hortorum*, *B. ruderarius* and *B. lucorum* appeared rarely, visiting: *Malus domestica*, *Rubus idaeus*, *Bellota nigra*, *Lamium album*, *Trifolium repens*, *Helianthus annuus*, *Consolida ajalis* and *Tagetes erectus*.

Wrotków quarter – cultivated fields. Extensive cultivated fields, situated on the southern fringe of Lublin, adjoin the private gardens of Dziesiąta and continue in the direction of Zemborzyce. Bumble-bees were caught on flowering plants on the grassy boundary strips (*Knautia arvensis*, *Medicago lupulina*, *Trifolium repens*, *Cichorium intybus*, *Centaurea cyanus*, *Vicia* sp. and others) and also on the fields of red clover (*Trifolium pratense*).

A total of 202 bumble bees were caught there (12.7%). The most numerous species proved to be *B. lapidarius* (14 individuals) and *B. terrestris* (57 individuals) chiefly visiting red clover and *Centaurea cyanus*. The less numerous species *B. ruderarius*, *B. hortorum* and *B. hypnorum* visited red clover and *Knautia arvensis*, *B. hypnorum* clearly preferring the flowers of the latter. The species *B. agrorum*, *B. lucorum*, *B. subterraneus*, *B. muscorum* and *B. equestris* appeared only sporadically.

In addition to the quarters mentioned single bumble-bees were caught in other parts of the town, including the parks at Bronowice and at Węglin. These parks consist of small groups of old trees and shrubs, with a very small number of flowering plants attractive to bumble-bees. Only single individuals of *B. terrestris* and *B. lapidarius* appeared there.

REVIEW OF SPECIES OF BUMBLE-BEES OCCURRING IN LUBLIN AND THEIR HOST PLANTS

A total number of 1597 bumble-bees were caught in the town, among which were 763 males, 60 females and 774 workers belonging to 15 species. The bees visited 64 species of plants (Tab. II).

B. lapidarius (L.). A common and numerous species. In Lublin it proved to be the most generally occurring bumble-bee (719 individuals, 45.0%). It occurred in all parts of the town but preferred ruderal biotopes and open areas, with a large number of flowering plants, in parks and squares. It occurred most numerously on wasteland in the Tatary quarter, on flowerbeds at the University Campus and in the People's park. It was also commonly found at Sławinek in the Botanical Garden and on wasteland, and also at Wrotków. It visited the flowers of plants and ornamental shrubs and also weeds. *B. lapi-*

Plants visited by bumble-bees in Lublin*

Tab. II

Species of plants / Species of bumble-bees	*B. lapidarius* (L.)	*B. terrestris* (L.)	*B. hyphorum* (L.)	*B. ruderarius* (Müll.)	*B. agrorum* (F.)	*B. hortorum* (L.)	*B. lucorum* (L.)	*B. muscorum* (F.)	*B. subterraneus* (L.)	*B. silvarum* (L.)	*B. confusus* (Schenck.)	*B. pomorum* (Pz.)	*B. pratorum* (L.)	*B. cynestris* (F.)	*B. humilis* (Ill.)	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ranunculaceae																
Consolida ajacis L.						3										3
C. regalis S.F. Gray	2		1	2		1										6
Crassulaceae																
Sedum sp.			1			1										2
Saxifragaceae																
Ribes grossularia L.					1											1
Rosaceae																
Malus domestica Borkh.			1	1												2
Rosa canina L.	1		1													2
Rubus caesius L.		1														1
R. idaeus L.	4	3	13	2	3											25
Spirea sp.	1		20										1			22

Papilionaceae																	
Caragana arborescens Lam.	1	1															2
Lotus corniculatus L.	2			1													3
Medicago falcata L.	1																1
M. sativa L.					1												1
Ononis spinosa L.	11	8		1		1	1										22
Trifolium pratense L.	34	38	1	30	14	19	3	4	6	1					1		151
T. repens L.	1			1													2
Vicia sp.	1	1					1										3
Malvaceae																	
Malva silvestris L.			1														1
Tropaeolaceae																	
Tropaeolum majus L.						2											2
Balsaminaceae																	
Impatiens glanduligera Royle						15											15
Hydrophyllaceae																	
Phacelia tanacetifolia Beuth.	30	24	4		1	1	1	1									61
Boraginaceae																	
Anchusa officinalis L.	37	29	2	12	3		1							1			85
Echium vulgare L.	31	29	5	8	3	1	1			1							80
Solanaceae																	
Lycium halimifolium Mill.	3	7		1	1												12
Scrophulariaceae																	
Antirrhinum maius L.		11		1													12
Digitalis purpurea L.		2															2
Linaria vulgaris (L.) Mill.			1								1						2
Veronica arvensis L.	5			2													7

Tab. II (cont.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Labiatae																
Ballota nigra L.	17	15	21	3	10	2	1		1							70
Lamium album L.	2			2	2											6
L. purpureum L.		4	2										1			7
Prunella vulgaris L.					1											1
Salvia officinalis L.	2	17	5	12	11											47
S. splendens Sellow.		1								1						2
S. verticillata L.		1														1
Plantaginaceae																
Plantago media L.		1														1
Caprifoliaceae																
Symphoricarpos albus (L.) Blake	14	4	9		1		1									29
Dipsaceae																
Knautia arvensis Coult	18	2	9													30
K. sp.				1												1
Campanulaceae																
Campanula medium L.		3					1									4
Compositae																
Achillea millefolium L.	1	1			3	2		3							1	11
Arctium lappa L.	3															3
Aster sp.	1															1
Calendula officinalis L.	2		1		1											4
Callistephus chinensis L.	4	1														5

Carduus acanthoides L.	201	29	7	2	1		2				2					244
C. crispus L.	37	20	1		2		1					1				62
Centaurea cyanus L.	25	18		1												44
C. rhenana Bor.	76	2		1				1								80
C. scabiosa L.	26									3						29
C. sp.	2	5		1		3	1									12
Cichorium inthybus L.	6	1														7
Cirsium lanceolatum (L.) Scop.	7	1								1						9
C. oleraceum (L.) Scop.		2														2
Cosmos hybridus Klondyke	2				1		1									4
Dahlia variabilis hybr.	55	84	3	4	4	1	2	2			1					156
Gailardia			1		1											2
Helianthus annuus L.	4	5	7		7		1									24
Hieracium sp.	1															1
Onopordon acanthium L.	2															2
Tagetes erectum L.	31	85			6	1					1					124
Taraxacum officinale Web.	6	1			1											8
Zinnia elegans Facq.	5	7				3										15
Liliaceae *Hosta japonica* Aschres						3										3
Caught in flight or dead	4	1	11		2											18
Total	719	465	128	89	81	59	19	11	8	8	4	2	2	1	1	1597

* Plants given in order according to Szafer's system, bumble-bees given in order of frequency of their occurrence

darius occurred in small numbers only in the Lipowa street and Unicka Street cemeteries, and in the private gardens in the Dziesiąta quarter, where many flowering wild and cultivated plants were growing.

B. lapidarius visited 42 species of plants in search of nectar and flower pollen. It most often visited the flowers of plants belonging to the *Compositae* family (497 individuals visited 21 species of plants, preferring *Carduus acanthoides*, *Centaurea* spp., *Dahlia variabilis* and *Tagetes erectus*. It also very readily visited the flowers of *Anchusa officinalis* and *Echium vulgare* (*Boraginaceae* family) – 68 bees were collected. It visited (51 bees were collected) 7 species of the *Papilionaceae* family, the majority of the bees being caught on *Trifolium pratense*.

B. terrestris (L.). A common and numerous species. It was less numerous than the preceding species (465 individuals, 29.1%) but was common and occurred in all parts of the town. It decidedly preferred open areas, well insolated, with a large number of flowering weeds and cultivated plants. It occurred most numerously at the University Campus, where it dominated slightly over *B. lapidarius*, visiting chiefly the flowers of *Tagetes erectus* and *Dahlia variabilis*. It also occurred abundantly on wasteland of a ruderal character at the Tatary quarter, but was distinctly less numerous than *B. lapidarius*; it mainly visited the flowers of *Echium vulgare*, *Anchusa officinalis*, *Carduus* spp., *Centaurea* spp. and *Ballota nigra*. Less numerous, but as a subdominant, it chiefly visited the flowers of red clover in cultivated fields at the Wrotków quarter. In parks and cemeteries it occurred less numerously, visiting the flowers of *Salvia officinalis*, *Dahlia variabilis*, *Tagetes erectus* and others.

B. hypnorum (L.). A fairly common and frequently numerous species. It readily settles in old trees with holes. It was, however, found to occur in small numbers in the town parks and wooded parts of Lublin cemeteries. 128 individuals were caught (8.0%). The majority of the individuals came from private gardens at the Dziesiąta quarter, where this species dominated over other species of bumble-bees. In spring it visited *Rubus idaeus*, and later on chiefly *Ballota nigra* and *Helianthus annuus*. At the University Campus quarter it occurred on the flowers of *Spirea* sp. In the People's Park this bumble-bee chiefly visited the flowers of *Symphoricarpos albus* and *Carduus acanthoides*. In fields at Wrotków it preferred the flowers of *Knautia arvensis*, and on ruderal wasteland at the Tatary quarter those of *Phacelia tanacetifolia* and *Echium vulgare*. Only 8 individuals were caught in the Lipowa Street cemetery, mainly on the flowers of *Salvia officinalis*. In addition numerous individuals were observed circling round a nest built in the cemetery keeper's house in a window which had been boarded up and stuffed with insulating material to keep out the cold. In other parts of the town this bumble-bees appeared only sporadically or was not observed at all. Individuals of *B. hypno-*

rum visited a total of 23 species of plants, the largest number of bees being caught on plants belonging to the *Rosaceae*, *Labiatae* and *Compositae* families.

B. ruderarius (Müll.). A common and frequently numerous species, but observed in small numbers only in Lublin. A total of 89 individuals were caught (5.6%), chiefly at the Tatary quarter (25 individuals on flowers of *Echium vulgare*, *Anchusa officinalis* and others), in cultivated fields at Wrotków (21 individuals primarily on *Trifolium pratense* and *Anchusa officinalis*) and at the Unicka quarter (18 individuals on *Trifolium pratense* and *Salvia officinalis*). A nest of this species hidden in a tuft of grass was found on the wasteland near Unicka Street. In other parts of the town single individuals only were caught when visiting flowering ornamental plants and weeds. *B. ruderarius* visited a total of 21 species of plants, decidedly preferring *Trifolium pratense*, *Salvia officinalis* and *Anchusa officinalis*.

B. agrorum (F.). A common and fairly numerous species, particularly near dense undergrowth. 81 individuals (5.1%) were caught in the town. It occurred in slightly larger numbers only in the private gardens at the Dziesiąta quarter (25 individuals), in comparison with other parts of the town, where only single individuals were caught. The bumble-bees visited 23 species of plants, preferring *Trifolium pratense*, *Salvia officinalis* and *Ballota nigra*.

B. hortorum (L.). A fairly common species, often numerous. It was observed in small numbers only in Lublin. 59 individuals were caught (3.7%) occurring sporadically in different parts of the town, and visiting 16 species of plants. The largest number of individuals was caught on the flowers of *Trifolium pratense* in the cultivated fields at Wrotków and on *Impatiens glanduligera* in the northern part of the town near the Unicka Street cemetery.

B. lucorum (L.). A species very similar to *B. terrestris*, but less numerous. In Lublin only single individuals of this species occurred. Only 19 were caught (1.2%), visiting fortuitously encountered flowers of 15 species of cultivated and wild plants, chiefly belonging to the *Compositae* family.

B. muscorum (F.). A fairly rare species, occurring more numerously locally. 11 individuals (0.8%) were caught in Lublin on the flowers of *Trifolium pratense*, *Achillea millefolium*, *Dahlia variabilis*, *Centaurea rhenana* and *Echium vulgare*.

B. silvarum (L.). A common and frequently numerous species. 8 individuals were caught on the flowers of *Centaurea scabiosa*, *Cirsium lanceolatum*, *Trifolium pratense*, *Echium vulgare*, *Linaria vulgaris* and *Salvia officinalis*.

B. subterraneus (L.). A rare species, occurring more numerously locally. 8 individuals were caught in the town on the flowers of *Trifolium pratense*, *Ballota nigra* and *Knautia arvensis*.

B. confusus Schenck. A rare species occurring in small numbers. 4 individuals were caught in the town, 2 of which visited the flowers of *Carduus acanthoides*, and the others *Dahlia variabilis* and *Tagetes erectus*.

B. pomorum Pz. A species occurring everywhere but in somewhat small numbers. Only 1 male was caught as it visited the flowers of *Carduus crispus*, and 1 worker on the flowers of *Anchusa officinalis*.

B. pratorum (L.). A forest species occurring in relatively small numbers. 1 male was caught on the flowers of *Spirea* sp. at the University Campus and 1 female on the flowers of *Lamium purpureum*.

B. equestris Ill. A rare species, occurring more numerously locally. The only worker caught was visiting the flowers of *Achillea millefolium* on a grass boundary between fields at Wrotków.

B. humilis Ill. A rare species, occurring more numerously locally. The only worker caught was visiting the flowers of *A. millefolium*.

DISCUSSION OF RESULTS

Fifteen species of bumble-bees were found to occur in Lublin. The most frequently encountered and most numerously occurring were *B. lapidarius* (45.0%) and *B. terrestris* (29.1%). These bumble bees occurred chiefly in parks and squares on various ornamental plants (chiefly *Tagetes erectus* and *Dahlia variabilis*) and also in open spaces such as wasteland, with abundantly flowering ruderal weeds (*Anchusa officinalis, Echium vulgare, Centaurea* spp. and others) and in cultivated fields with flowering *Trifolium pratense*. The far less numerous *B. hypnorum* (8.0%) in the private gardens at the Dziesiąta quarter dominated over other species. At this quarter *B. agrorum* (5.1%) was one of the most numerous species of bumble-bees. *B. ruderarius* (5.6%) preferred open and well insolated sites. It occurred most numerously on the ruderal weeds at the Tatary quarter and on *Trifolium pratense* in the cultivated fields at Wrotków and neglected meadow near Unicka Street. At other quarter it appeared very infrequently. *B. hortorum* (3.7%) in the Unicka area was, together with *B. ruderarius*, among the most numerous bumble-bees, but mainly visited *Impatiens glanduligera*, and in the fields at Wrotków – *Trifolium pratense*, but in comparison with other bumble-bees was not numerous. The remaining species of bumble-bees were encounterred only sporadically in the town. These were females seeking for suitable places to make a nest in spring, or workers flying there from a distance in search of nectar for food.

The habitat in which the largest numbers of bumble-bees were observed was the wasteland at the Tatary quarter, where collection was made of 28.3%, on ruderal weeds, and 25.9%, on the flower beds of the University Campus, of all the individuals caught. The largest number of species (11) of bumble-bee occurred at these quarter and in the cultivated fields of Wrotków (12.7%), but not all the species occurred in both (Tab. I). Bumble-bees appeared only sporadically in the parks at Węglin and Bronowice, which are almost completely

devoid of attractive entomophilous flowering plants. In the Saxon Garden where the number of flowering plants, apart from roses, was small, bumble--bees also occurred in very small numbers. There were few bumble-bees in the very shady Lipowa Street cemetery, despite the abundance of flowers. There were also relatively few bumble-bees in the Unicka area, on either the numerous flowers in the cemetery or in the neglected meadow.

Bumble-bees visited 64 species of plants belonging to 19 families. The greatest number of visits were made to plants of the Compositae family (23 species), bumble-bees being most often found on *Carduus acanthoides* (244 individuals), *Dahlia variabilis* (156 individuals) and *Tagetes erectus* (124 individuals). A total number of 849 bumble-bees were caught on the plants belonging to this family. 185 bumble-bees were caught on 8 species of the *Papilionaceae* family, 151 of them on *Trifolium pratense*. 134 bumble-bees were caught on plants of the *Labiatae* family, visiting 7 species of these plants, with greatest preference for *Ballota nigra* (70 individuals) and *Salvia officinalis* (47 individuals). Of the *Boraginaceae* family these insects visited *Anchusa officinalis* and *Echium vulgare*, and a total of 165 individuals were caught on these plants. A plant fairly readily visited was also *Phacelia tanacetifolia* of the *Hydrophyllaceae* family (61 bees collected).

In all, the greatest number of bumble-bees were collected from the flowers of *Carduus acanthoides* (244 individuals), *Dahlia variabilis* (156 individuals), *Trifolium pratense* (151 individuals) and *Tagetes erectus* (124 individuals). The largest number of species of plants was visited by *B. lapidarius* (42 species) and *B. terrestris* (35 species).

The majority of the plants visited by bumble-bees in Lublin have flowers with deeply hidden nectaries accessible only to insects with specially elongated structure of the mouth apparatus. Szafer (1969) has defined these flowers as hymenoptereal, covering two large biological groups. Flowers of one of them are pollinated chiefly through the agency of *Apidae*. Bumble-bees play an important part in the pollination of these flowers. Flowers in the second group are pollinated chiefly by *Vespidae*.

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PRZYCZYNEK DO ZNAJOMOŚCI TRZMIELI MIASTA LUBLINA

Streszczenie

Autorka badała trzmiele występujące na terenie Lublina zwracając uwagę na zasiedlenie poszczególnych dzielnic miasta i rośliny żywicielskie tych owadów. W latach 1964 i 1966 w Lublinie złowiono 15 gatunków trzmieli, z których najliczniejszymi były *Bombus lapidarius* (L.) (45,0%) i *B. terrestris* (L.) (29,1%). Powszechnie, ale znacznie mniej licznie, występowały gatunki: *B. hypnorum* (L.) (8,0%), *B. ruderarius* (Müll) (5,6%), *B. agrorum* (F.) (5,1%) i *B. hortorum* (L.) (3,7%). Trzmiele te występo-

wały głównie w parkach i na skwerach, a także na nieużytkach z dużą ilością kwitnących chwastów. Catunki *B. lucorum* (L.), *B. muscorum* (F.), *B. silvarum* (L.), *B. subterraneus* (L.), *B. confusus* Schenck., *B. pomorum* Pz., *B. pratorum* (L.), *B. equestris* (F.) i *B. humilis* Ill. pojawiały się sporadycznie.

Największe ilości trzmieli występowały na ruderalnych nieużytkach w dzielnicy Tatary (28,3%), na rabatach kwiatowych Miasteczka Uniwersyteckiego (25,9%) oraz na polach uprawnych Wrotkowa (12,7%).

Obserwowane trzmiele oblatywały 64 gatunki roślin należących do 19 rodzin. Najczęściej trzmiele odwiedzały kwiaty roślin z rodziny *Compositae* (23 gatunki). Spośród oblatywanych roślin trzmiele zdecydowanie wyróżniały *Carduus acathoides* i *C. crispus*, *Dahlia variabilis*, *Tagetes erectus*, *Centaurea* spp. Bardzo chętnie odwiedzały również kwiaty *Trifolium pratense* (*Papilionaceae*), *Anchusa officinalis* i *Echium vulgare* (*Boraginaceae*), *Ballota nigra* i *Salvia officinalis* (*Labiatae*) i *Phacelia tanacetifolia* (*Hydrophyllaceae*). Najwięcej gatunków roślin odwiedziły *B. lapidarius* (42 gatunki) i *B. terrestris* (35 gatunków).

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